

JC821 U.S. PTO  
09/05535  
05/16/01



AN IMPLEMENT FOR AUTOMATICALLY DETACHING AND DISPLACING AN AMOUNT OF FEED, SUCH AS FOR EXAMPLE SILAGE OR HAY

The invention relates to an implement for automatically detaching and displacing an amount of feed, such as for example silage or hay, from a stock of feed, said implement being provided with a robot arm with a detaching member which is suitable for detaching a part of the feed from the stock and displacing it to a predetermined place and depositing it there. Such an implement has the advantage that, in a simple manner, a measured out amount of feed, in particular fodder that is difficult to handle, such as silage or hay, can be detached from a stock of feed and be displaced to a predetermined place. In particular in relation to the known constructions, in which for example an auger is used, the above-mentioned implement has the advantage that with the aid of the robot arm various stocks of feed can simply be reached by the robot arm with the detaching member.

According to a further inventive feature, the detaching member comprises a gripping element. The gripping element has the advantage of being less sensitive to clogging. A gripping element has the further advantage of making it possible for example to detach a tuft of hay from a bale of hay.

In a preferred embodiment of the invention, the detaching member comprises a bucket or a shovel. By means of the bucket or the shovel it is in particular possible to detach in a simple manner blocks of concentrate from a stock of feed.

According to another inventive feature, the detaching member is capable of being closed. Especially when granular or pulverulent material has to be detached from a stock of feed, it is of importance that the detaching member can be closed for the purpose of preventing loss of feed during transport.

In order to prevent the detaching member from being contaminated, the robot arm is provided with cleaning and/or brushing means for the detaching member. In a preferred

embodiment of the invention, the cleaning and/or brushing means comprise a sweeping element. For the purpose of being able to detach from the stock a previously measured out portion of feed, the implement comprises metering means.

5 According to again another inventive feature, the implement comprises weighing means for weighing said portion of feed. According to a further inventive feature, the robot arm comprises the weighing means. In order to be able to determine where and when a particular amount of feed can be  
10 deposited by the robot arm with the detaching member, the implement comprises animal identification means, with the aid of which an animal can be identified. According to a further inventive feature, the animal identification means are fitted on the robot arm. This measure has the advantage that, for  
15 example in the situation that a feeding column with various feeding troughs is used, it is not necessary to provide each feeding trough with animal identification means.

According to a further inventive feature, the implement comprises at least one feeding and/or watering trough. According to another inventive feature, the implement comprises at least one container for storing the fodder and/or drink. In a preferred embodiment of the invention, the robot arm is disposed above the feeding and/or watering trough and/or above the container. According to again another  
25 inventive feature, the implement is provided with a chute via which the feed can be discharged to a relevant feeding and/or watering trough. In an embodiment of the invention, the robot arm has such dimensions that the detaching member can move over and/or along the bottom of the container and/or the  
30 feeding and/or watering trough. Thus it is possible to take the last remnants of feed from the container or the trough. In order to be able also to use the robot arm for example in a loose house, the robot arm is at least movable over the floor of the stable. In a preferred embodiment of the invention, the  
35 robot arm is movable along a rail. It will be obvious that it is also possible to dispose the robot arm for example on belts, such as caterpillar tracks, and to move it in this

manner through the stable. According to again another embodiment of the invention, the implement comprises one or more transport vehicles that co-operate with the robot arm. Thus it is possible, for example in a stable, to convey by 5 means of the transport vehicles the feed that has been detached to a particular place and to deposit it there. In a preferred embodiment of the invention the transport vehicles are movable along a rail. The above-mentioned implement can in particular be applied in a feeding column with various feeding 10 and/or watering troughs to which the animals are allowed to go.

The invention will now be explained in further detail with reference to the accompanying drawings, in which:

15 Figure 1 is a cross-section of the implement according to the invention;

Figure 2 is a second embodiment of an implement according to the invention, and

20 Figure 3 is a plan view of a loose house in which a third embodiment of the implement according to the invention is depicted.

Figure 1 is a cross-section of an implement 1 for automatically detaching and displacing an amount of feed. The 25 implement 1 is provided with a robot arm 2 with a detaching member 3 which is suitable for detaching feed from containers 4 that are integrated in a feeding column 5. The feeding column 5 comprises feeding and/or watering troughs 7 that are disposed around a central axis 6 and from which animals, such 30 as cows for example, can eat and/or drink. Each of the feeding troughs 7 is capable of being closed separately by means of a closing member 8 which is constituted by a lid in the present embodiment. Under each of the feeding troughs 7 there is disposed a load cell 9 with the aid of which the weight of a 35 relevant feeding trough can be determined. As shown in Figure 1, the robot arm is arranged centrally above the containers 4. This measure has the advantage that the robot arm 2 with the

detaching member 4 can reach in a simple manner all the containers 4, as well as the feeding troughs 7. The robot arm 2 is also provided with a weighing device 10 which is designed as a load cell in the present embodiment. By means of the 5 weighing device 10 it is possible to determine each time how much feed is taken from a container 4 and deposited in a particular feeding trough 7. The robot arm 2 is further provided with a first stepper motor 11 with the aid of which the robot arm 2 can be rotated about a vertical axis 12. The 10 robot arm 2 is further provided with two further stepper motors 13 with the aid of which the robot arm can be positioned in the vertical plane. The end of the robot arm 2 comprises a telescopic cylinder 14. In the present embodiment the detaching member 3 is designed as a gripper 15 with the 15 aid of which feed can be seized and be released. Near the detaching member 3 there is further disposed an animal identification system 16 which makes it possible to recognize an animal that is standing near one of the troughs 7. By means of the animal identification system 16 and a (non-shown) 20 computer it can thus be determined whether or not an animal that is waiting near a feeding trough 7 will be fed. Upon feeding the animals it is possible to compose a meal of feed from various containers 4 for a relevant animal. The gripper is particularly appropriate when roughage, such as for example 25 silage or hay, has to be taken from a container 4. It will be obvious that it is also possible, of course, when remnants of feed are still present in the feeding troughs 7 after a particular animal has eaten there, to take these remnants back by means of the robot arm 2 and to displace them to a relevant 30 container 4 and deposit them there.

Figure 2 shows a second embodiment of an implement 1 for automatically detaching and displacing an amount of feed from a container 4 of a (not completely depicted) feeding column 5. In the present embodiment the robot arm 2 is 35 differently designed than the robot arm 2 according to Figure 1. However, corresponding parts are indicated by the same reference numerals. By means of the upper stepper motor 13 it

is possible to move the detaching member 3 along the curved lines of the container 4, while the lower stepper motor 13 makes it possible to move the entire robot arm 2 upwards or downwards. To allow the latter movements, the robot arm 2

5 comprises a quadrangular pivot construction 17. In the present embodiment the detaching member 3 comprises a bucket 18 which is disposed at the end of the robot arm 2. With the aid of the bucket 18 feed can be scooped from the container 4. By means of a closing mechanism 19 it is possible to close the bucket

10 18 after the latter has been filled completely, so that feed is prevented from falling from the bucket during transport. For that purpose the closing mechanism 19 comprises a closing lid 20 which is connected by means of a steering rod 21 to a stepper motor 22 which, after having been energized, causes

15 the bucket 18 to be closed or opened. The closing mechanism 19 is further coupled with cleaning means 23 that are moved along the bottom and/or along the walls of the bucket 18 during opening and/or closing of said bucket 18. For that purpose the cleaning means 23 comprise a brushing element 24. When the

20 bucket 18 has been filled completely, said bucket 18 is moved by means of the robot arm 2 to a chute 25 where the feed is poured into the chute 25 by activating the closing mechanism 19. Via the chute 25 the feed is poured into a predetermined and not further shown feeding trough, such as the feeding

25 trough 7 in Figure 1. By means of torque measurements on the stepper motors 11 and/or 13 it is possible to determine whether the bucket is full or empty during detaching feed from the containers 4. It will be obvious that the implement according to Figure 2 can be completely integrated in the

30 feeding column 5 as shown in Figure 1.

Figure 3 is a plan view of a stable 26 with a third embodiment of an implement 1 according to the invention arranged therein. The stable 26 comprises two rows of feed stands/cubicles 27 and at the end thereof two storage areas 28 for storing roughage and/or concentrate. The storage areas 28 each comprise a plurality of containers 4 for storing various sorts of fodder and/or drink. Between the two rows of feed

stands 27 and the storage areas 28 there is disposed a rail 29 along which a transport vehicle 30 can be moved automatically under computer-control. By means of the robot arm 2 feed can be deposited from a container 4 into the transport vehicle 30 5 by means of the detaching member 3. The robot arm 2 of the implement 1 in Figure 1 may be designed as the robot arm in Figure 1 or Figure 2. The robot arm 2 is also automatically movable under computer-control along the rail 29. With the aid of (non-shown) animal identification means it is thus possible 10 to convey feed to a predetermined feed stand both by means of the robot arm 2 and the transport vehicle 30. It will be obvious that it is also possible to arrange a stationary robot arm 2 between the storage areas 28 and to convey the feed to a particular place only by means of the transport vehicle 30.